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PREDICTIVE POWER FOR PROGRAM SUCCESS FROM ENGINEERING AND MANUFACTURING DEVELOPMENT PERFORMANCE TRENDS

CHARLES K. GAILEY III

November 2002

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ABSTRACT

This study examined 28 acquisition program characteristics to determine if any of them could be a predictor of program performance during the Engineering and Manufacturing Development (EMD) phase of development. A population of 46 programs (with EMD completion dates from 1980 to 1997) was used. The population was divided into two groups using EMD duration overrun as the criterion. The two groups were confirmed as statistically separate for schedule. Defining the greater overrun group as the “bad” programs, it was found that all the characteristics correlated to “badness” were dependent on schedule performance; they were descriptive rather than predictive. It was also found that the Selective Acquisition Reporting system had succeeded in identifying the “bad” programs; but corrective measures, if any, were ineffective. Additional research indicated that the contract type most likely to lead to success in EMD was Cost Plus Incentive Fee.

ACKNOWLEDGMENTS

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ACRONYM LIST

ACTD	Advanced Concept Technology Demonstration
ADM	Acquisition Decision Memorandum
AFATDS	Advanced Field Artillery Tactical Data System
ASAT	Anti-Satellite
ATACMS	Army Tactical Missile System
AWACS	Airborne Warning and Control System
BLRIP	Beyond Low Rate Initial Production
CCTT	Close Combat Tactical Trainer
CMUP	Conventional Munitions Upgrade Program
CPAF	Cost Plus Award-Fee (Contract)
CPIF	Cost Plus Incentive-Fee (Contract)
COI(E)	Critical Operational Issues (Effectiveness)
COI(S)	Critical Operational Issues (Suitability)
CSSCS	Combat Service Support Control System
DAB	Defense Acquisition Board
DAU	Defense Acquisition University
DIVAD	Division Air Defense
DoD	Department of Defense
DOT&E	Director, Operational Test and Evaluation
DSMC	Defense Systems Management College
DT	Developmental Testing
DEM/VAL	Demonstration/Validation
EMD	Engineering and Manufacturing Development
EOA	Early Operational Assessment
EPLRS	Enhanced Position Location and Reporting System
FAADC ³ I	Forward Area Air Defense Command, Control, Communication and Intelligence
FFP	Firm-Fixed-Price (Contract)
FOT&E	Follow-on Operational Test and Evaluation
FPI	Fixed-Price Incentive (Contract)
FRP	Full-Rate Production
FY	Fiscal Year
GBS	Ground Based Sensor
IOT&E	Initial Operational Test and Evaluation
JDAM	Joint Direct Attack Munition
JSOW	Joint Stand-Off Weapon
JTIDS	Joint Tactical Information Distribution System
LRIP	Low Rate Initial Production
MS	Milestone
NDI	Non-Developmental Item
OA	Operational Assessment
OPEVAL	Operations/Operational Evaluation
OT	Operational Testing

OTA	Operational Test Activity
PDM	Program Decision Memorandum
PDRR	Program Definition and Risk Reduction
PM	Program Manager
RDT&E	Research, Development, Test and Evaluation
RSIP	Radar System Improvement Program
SAR	Selected Acquisition Report
SD	Standard Deviation
SINCGARS	Single Channel Ground to Air Radio System
SMART-T	Secure Mobile Anti-Jam Reliable Tactical Terminal
SME	Subject-Matter Expert
SSDS	Ship Self-Defense System
S/W	Software
TE	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TRITAC	Tri-Service Tactical Communications Program
TY	Then Year
WBS	Work Breakdown Structure

CHAPTER 1

PREDICTIVE CHARACTERISTICS

1. Purpose

It would be useful if acquisition program reviewers and approval authorities could predict whether a given program is at greater (or lesser) than average risk for performing poorly in the Engineering and Manufacturing Development (EMD) phase. Existing tools examine past performance of programs in terms of cost and schedule. The EMD Performance Project spreadsheet offers the capability of examining more program characteristics. The present research was performed in hopes of identifying a predictive characteristic that would be included in a program's plan at the inception of EMD and would alert reviewers to an increased risk of poor program performance.

2. Methodology

The spreadsheet developed by the EMD Performance Project is published in several Defense Systems Management College (DSMC) and Defense Acquisition University (DAU) Technical Reports.¹ Using the spreadsheet and Program Schedule Overrun as the criterion (see Figure 1), 46 programs that completed EMD were divided into three groups. The groups were: within a 75 percent overrun of plan; between 130 percent and 140 percent overrun; and between 160 percent and 180 percent overrun.

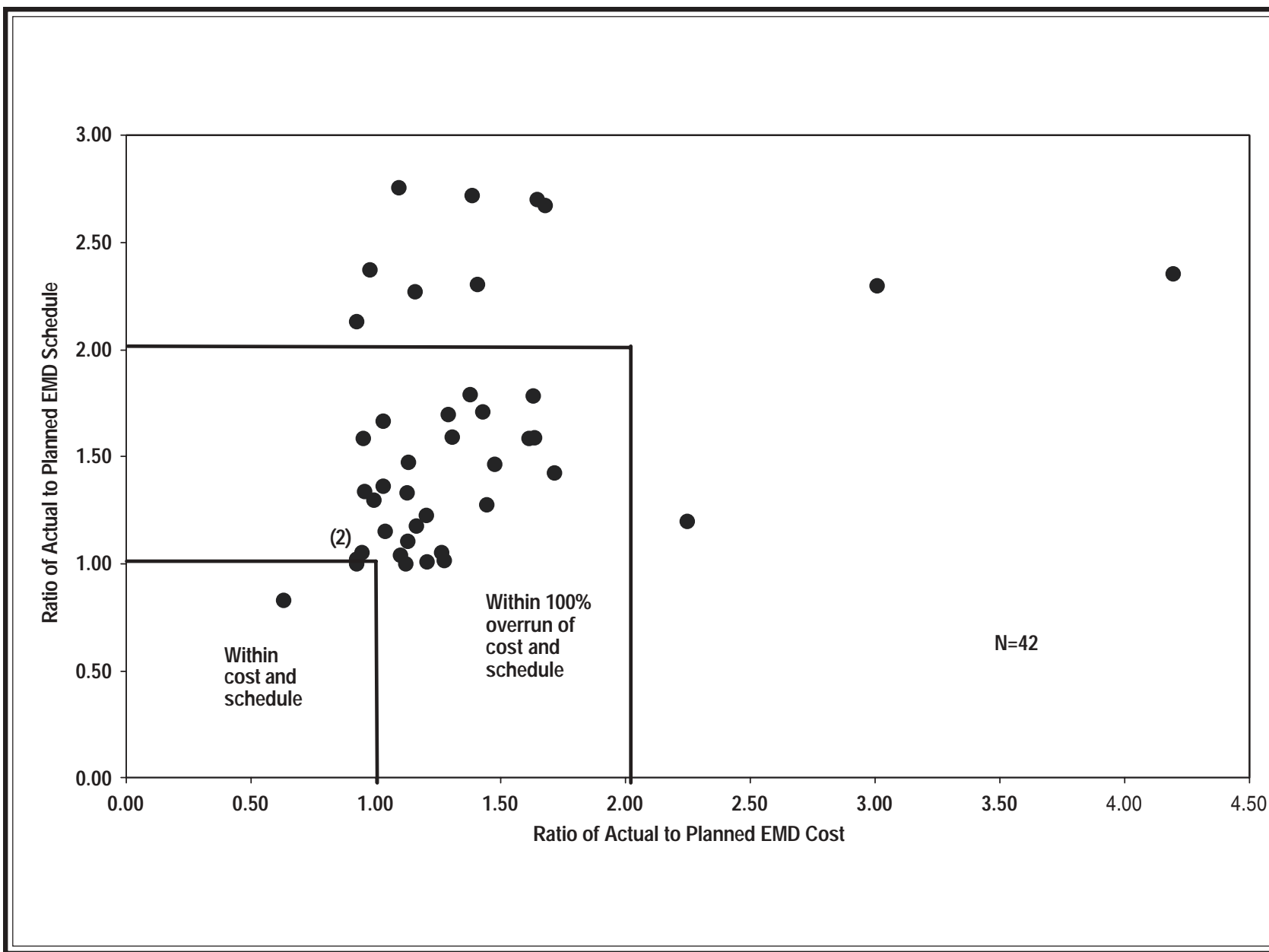
For the first group, the mean, median and standard deviation was computed for each of 28 program characteristics.² The median was computed for each of the second and third groups; the mean and standard deviations were considered inappropriate statistics due to the small number of members in these groups.

For each characteristic, the medians of groups two and three and the combined group were compared to the two standard deviation ranges of the first group. Some characteristics were not used since their large standard deviation relative to the mean indicated the data were too scattered to be meaningful.

¹ See Appendix B; reports were published in 1995, 1999, 2000, and 2001.

² *Ibid.*; analyses including all 71 characteristics were reported in these references. Twenty-eight characteristics were selected for this study because they permitted statistical analysis beyond previous work.

Figure 1. Ratio of Actual to Planned EMD Cost and Schedule



3. Results

a. Characteristics that were used for comparisons.³

Program Characteristic	2 SD Range < 75%	130%-140%	Median 160%-180%	Over 130%
EMD Plan (Years)	1 to 9.4	4.5	3.75	4.1
EMD Actual (Years)	1.7 to 11.7	10.2	10.1	10.1
EMD Overrun (Months)	-14 to 50	68	76	73
EMD Duration Actual/Plan	0.78 to 1.86	2.31	2.70	2.37
EMD Duration % Overrun	-22 to 86	131	170	137
EMD RDT&E \$TY Actual/Plan	0.62 to 1.86	1.41	1.52	1.41
PM Number	1 to 5	4	3.5	4
PM Average Tenure (Years)	0 to 5	2.1	2.6	2.4
Annual SARs	1 to 12	8	11	10
Exception SARs	0 to 11	2	11	3
SARs (Except/Ann %)	0 to 153	29	103	38
Number of Procurement Changes	0 to 6	2	3	2

³ See Appendix E for the definitions of program characteristics.

b. Characteristics that were not used for comparisons.

Program Characteristic	Median < 75%	Mean < 75%	SD < 75%
Cost % Overrun	13	24	31
Schedule Success (5 to 1)	3	2.7	1.4
EMD RDT&E TY\$M Plan	365	727	1309
EMD RDT&E TY\$M Actual	447	832	1375
LRIP # (RDT&E \$)	9	42	88
LRIP # (Procurement \$)	56	2,713	13,301
LRIP # Total	64	2,568	12,859
Procurement (Proc) # Plan	767	3,422	5,876
Proc # Actual	758	6,325	22,518
Proc # % Plan/Actual	0	-0.5	83
% RDT&E LRIP/Total Proc	1.3	2.6	3.7
% Proc LRIP/Total Proc	8.3	11.7	15.5
LRIP/Total Proc %	9.8	14.6	16.9
RDT&E LRIP/Total LRIP %	23	33	34
Subcontractors	2	2.3	2.6
IOT&E Duration (Years) Actual/Plan	0.9	1.5	1.3

CHAPTER 2

UPDATE OF 1995 RESULTS

In Technical Report TR 2-95, May 1995, preliminary data using information from 24 acquisition programs were examined for any relationship between LRIP quantities and the success of the program in EMD. Since then, the data have been expanded to include 46 programs that have completed EMD. The expansion to 46 programs generated an interest in updating the 1995 charts to reflect a larger data set. In the following discussion, the solid bars are for the 46-program data set.

Figure 2 (Figure 3 in the 1995 report) displayed the relationship between LRIP test articles and schedule slippage. The data for the larger set of programs indicate that there appears to be no correlation between LRIP quantities and the probability that the schedule will slip. This lack of trend at even detailed scale is shown in Figures 3 and 4 (Figures 4 and 5 in TR 2-95).

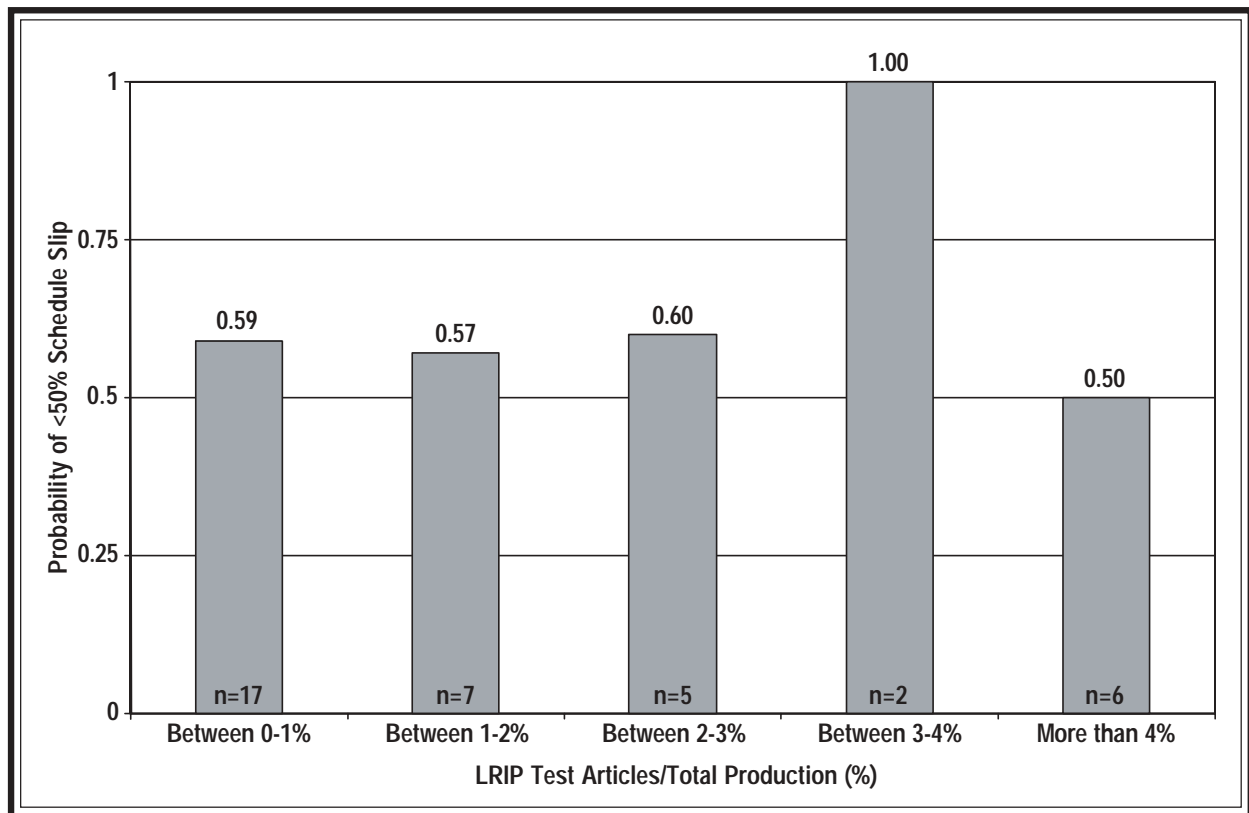


Figure 2. LRIP Test Articles and Schedule Slippages

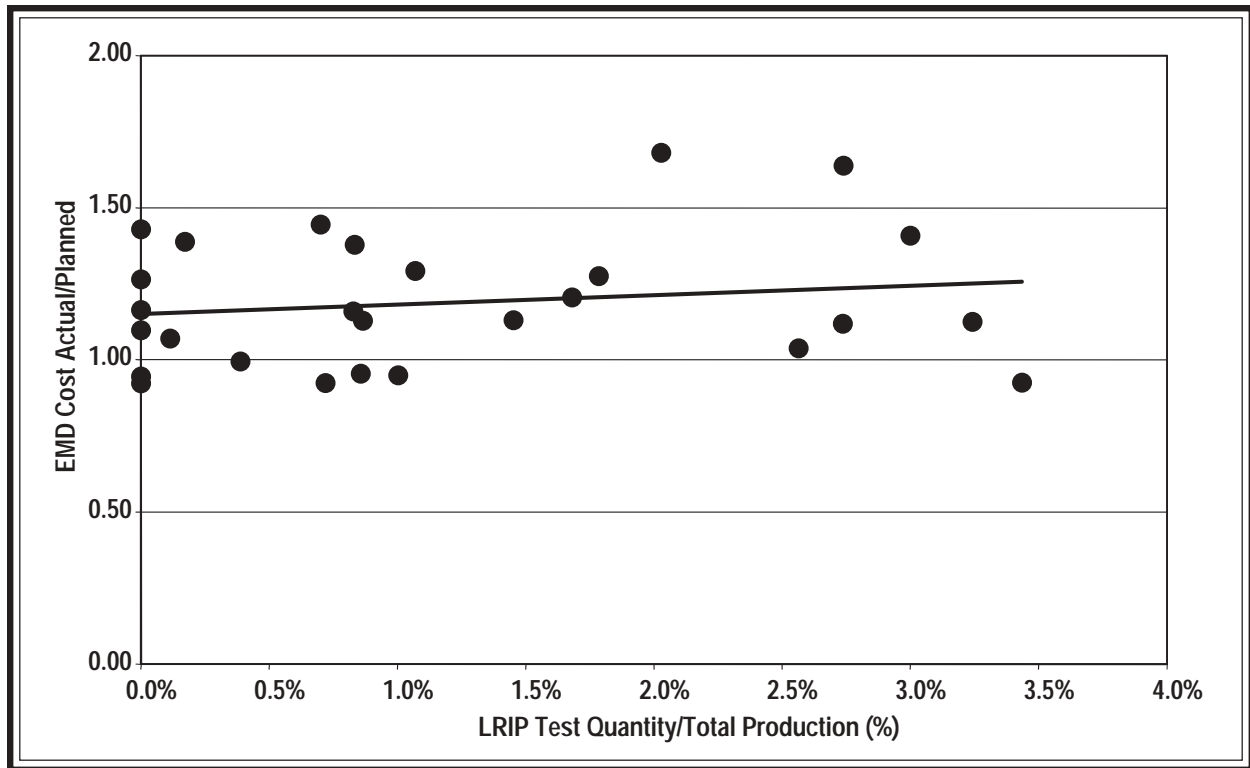


Figure 3. LRIP Test Quantity vs. EMD Cost Overrun

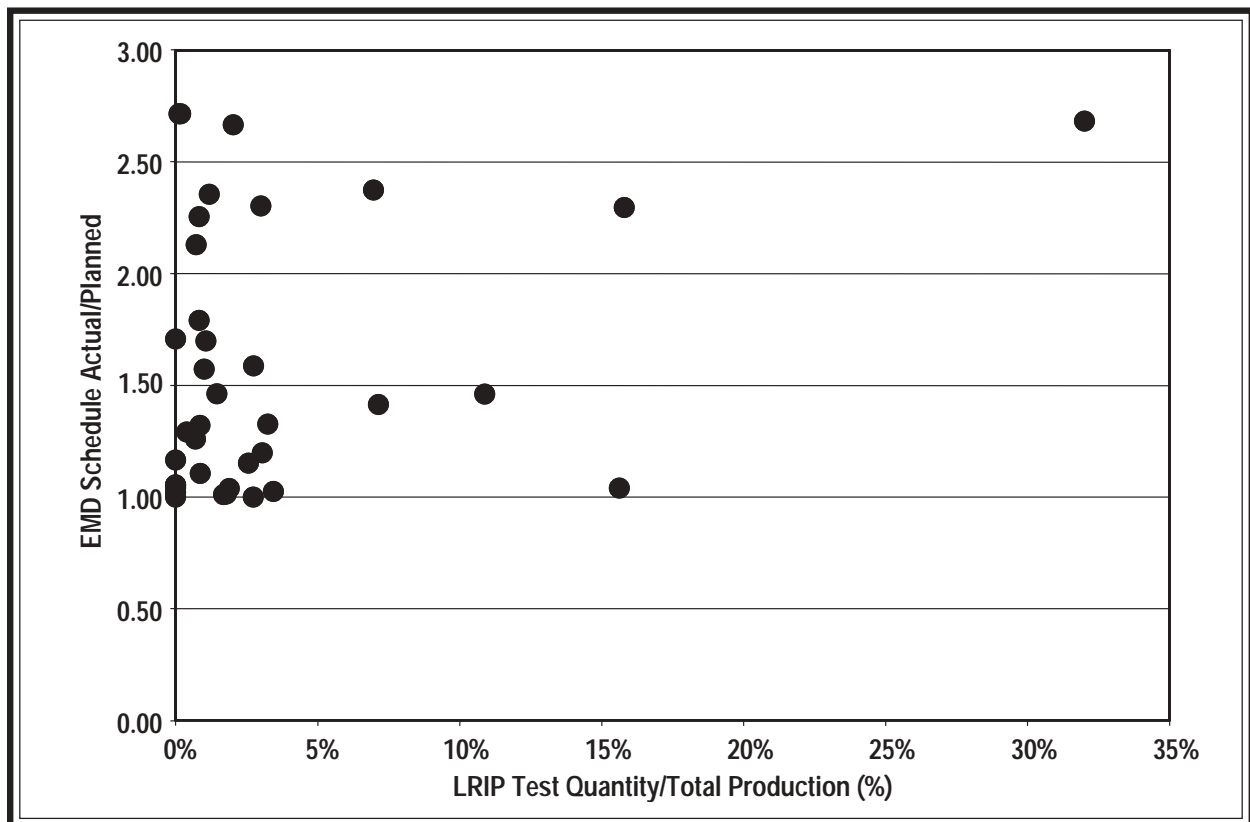


Figure 4. LRIP Test Quantity/Total Production (%)

Figure 5 shows competition in the Demonstration/Validation Phase (DemVal) (Figure 7 in TR 2-95); the larger data set reduced the advantage indicated by not using competition, although the difference is still significant.

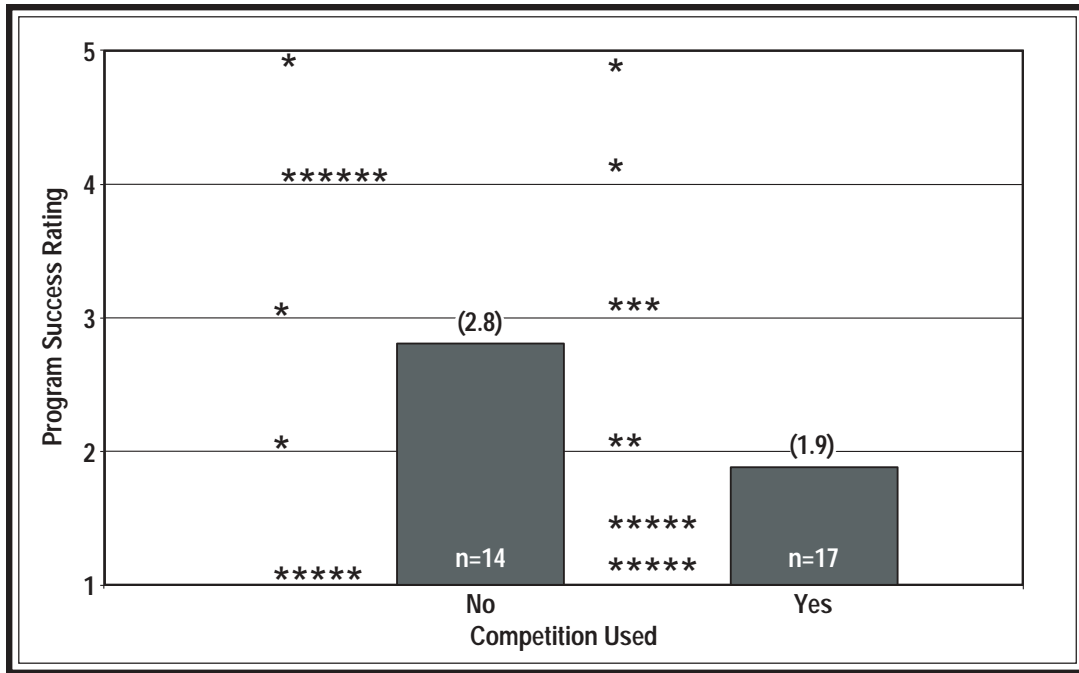


Figure 5. Competition in Demonstration/Validation

Figure 6 shows the competition in EMD. The 1995 data shows an advantage for no competition; the larger data set indicates no significant difference.

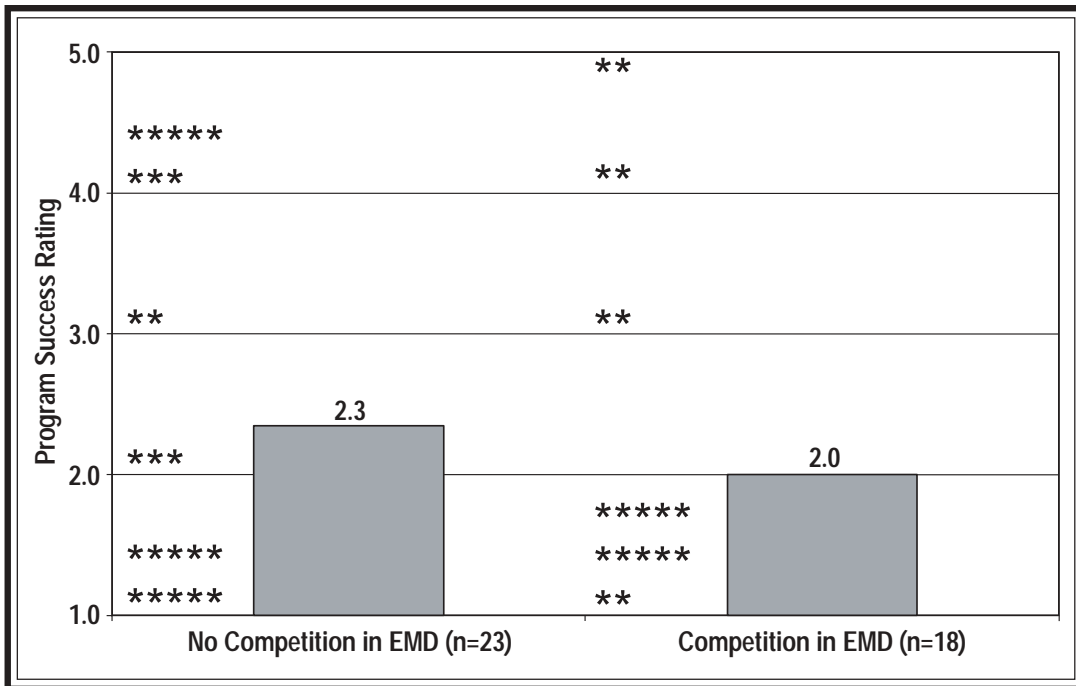


Figure 6. Competition in EMD

The type of contract used for the EMD phase is shown in Figure 7. The 1995 smaller data set shows the same success whether CPIF, FPI or FFP contracts were used; CPAF produced significantly poorer results. The 46-program data set indicates marked preference for CPIF contracts. The other three types have significantly lower results.

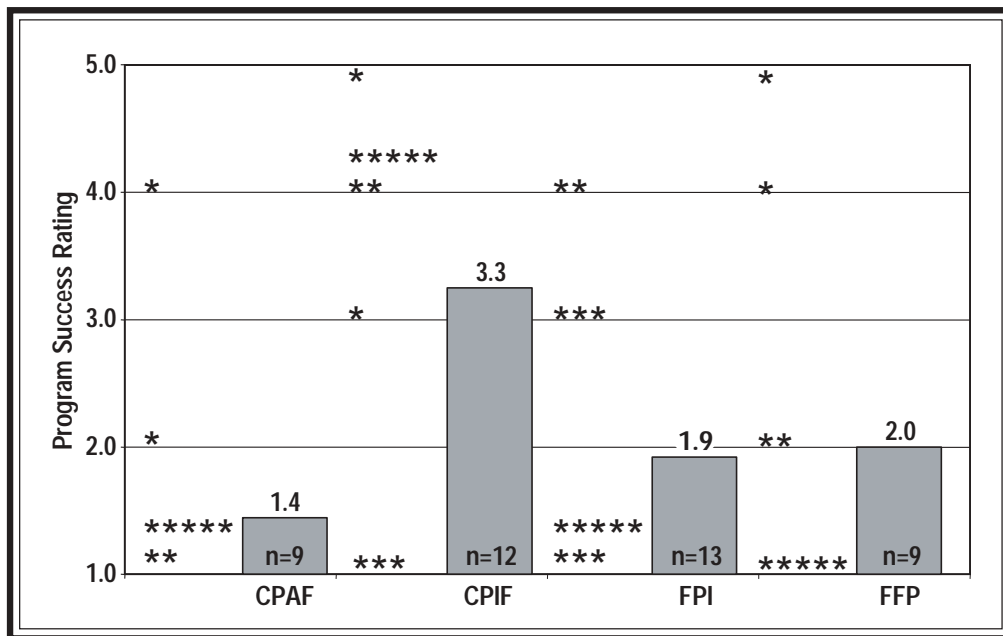


Figure 7. Type of Contract in EMD

Figure 8 shows the relationship between a program's success and the number of associated contractors used.

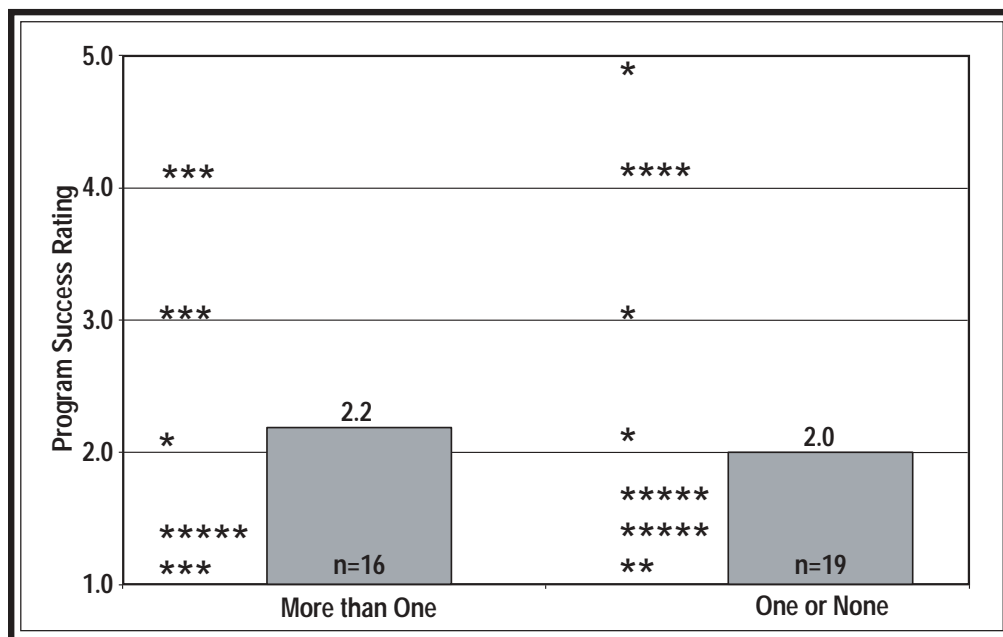


Figure 8. Number of Associate Contractors

Figure 9 illustrates the relationship between a program's success and whether or not it is Single- or Joint-Service. The larger data set indicates that neither provides a significant correlation.

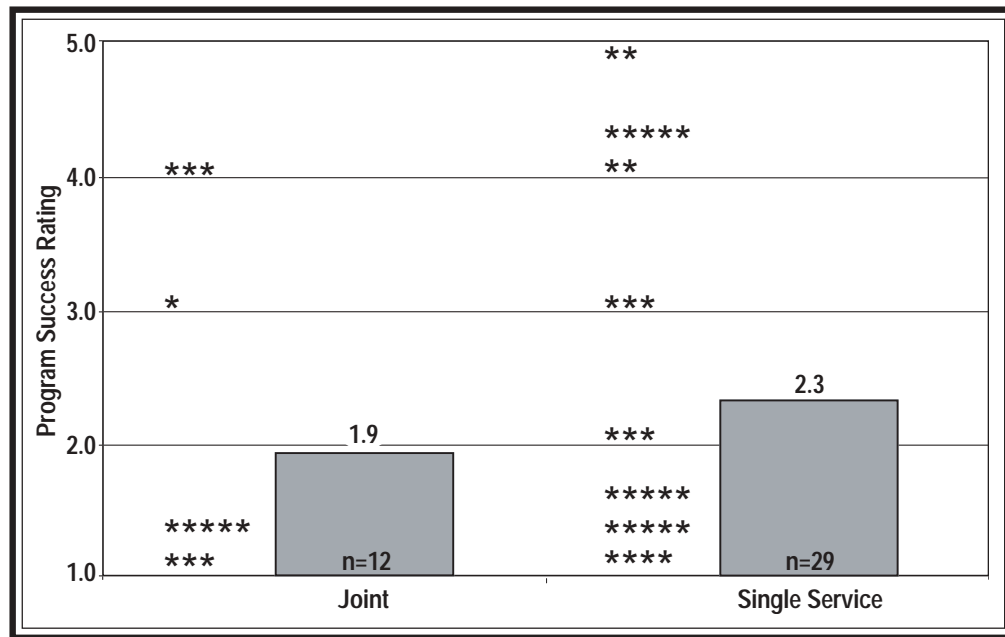


Figure 9. Single/Joint Programs

The conclusions of the comparison of results from the 24-program data set to the 46 programs follow:

1. Larger numbers of LRIP items do not improve program schedule performance.
2. Programs that did not compete DemVal had higher success.
3. CPIF contracts in EMD produced greater success than CPAF, FPI or FFP contracts.
4. No difference in EMD success can be attributed to whether EMD is competed, how many associated contractors are present or whether the program is Joint-Service.

CHAPTER 3 CONCLUSIONS

1. Of the 28 program characteristics that were examined, 16 exhibited scatter that was too extreme to provide reliable predictive power.

2. With regard to schedule overrun, the programs that have completed EMD fall into two groups; the pattern, which appeared in plotting program overrun on schedule, is real. The groups consist of programs that completed EMD within 75 percent overrun of the plan schedule and programs for which the schedule overrun fell between 130 percent and 180 percent. (There was no significant difference between the 130 percent–140 percent and the 160 percent–180 percent groups, so they could be combined.) The latter fell outside the 2SD range of the former, both for months of overrun and for percent of overrun.

3. Using the group of programs with between 130 percent and 180 percent overrun as the set of “bad” programs, there was no difference between them and the other programs with regard to 6 characteristics.

4. The group of “bad” programs fell outside the 2SD range of “good” programs in three characteristics: months of overrun, ratio of overrun and percent of overrun. This confirms the identity of the group but does not present a predictor.

5. With regard to three characteristics, the median of the “bad” group fell at the extreme end of the 2SD range of the “good” group.

1) EMD (actual). The “bad” group’s median of 10 years is not independent of schedule overrun; this would be another descriptive characteristic rather than a predictive characteristic.

2) Annual SARs. The high number of SARs reflects the extended duration of EMD. Again, this is descriptive rather than predictive.

3) Exception SARs. The small group of programs with over 160 percent schedule overrun had an extremely high number of exception SARs. Many of these exception SARs reflect baseline breaches for schedule. However, baseline breaches for other than schedule were also present. The “very bad” programs were identified by the SAR reporting system. It is unclear what corrective measures were taken, but the evidence shows they were not effective.

6. Programs using a Cost Plus Incentive Fee contract had significantly better success than did programs using Cost Plus Award Fee, Fixed-Price Incentive or Firm-Fixed-Price contracts.

7. In Demonstration/Validation, programs that used a single contractor rather than competition had better success in EMD.

CHAPTER 4

RECOMMENDATIONS

1. Further analysis of the spreadsheet data , especially three-way correlations, should be undertaken to understand the behavior of acquisition programs between the beginning of EMD and the approval for full-scale production.
2. Further examination is necessary to discover why competition in Demonstration/Validation is less likely to produce successful EMD performance than the use of a single contractor.

APPENDICES

Appendix A — Author's Note

Appendix B — Bibliography

Appendix C — Cost, Schedule and Performance Success Criteria

Appendix D — Spreadsheet Column Headings

Appendix E — Spreadsheet Column Descriptions

Appendix F — Program-specific Notes

Appendix G — Excel Spreadsheet Data

APPENDIX A AUTHOR'S NOTE

C.K. Gailey III was a professor of engineering management at DSMC and is now a visiting research professor. He is a graduate of Rice University, Florida Institute of Technology, the Army War College and the DSMC Program Management Course. He was a member of the DSMC Test and Evaluation Department. He has more than 25 years' experience in the acquisition, fielding and support of Army materiel.

APPENDIX B BIBLIOGRAPHY

Gailey, C.K., Reig, R.W., Weber, W., and George, L.R., *A Study of the Relationship between Initial Production Test Articles used in a System Development Program and the Success of the Program*, Technical Report 2-95, May 1995, Defense Systems Management College, Fort Belvoir, VA.

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APPENDIX C

COST, SCHEDULE AND PERFORMANCE SUCCESS CRITERIA

Very Successful (Score of 5)

There are few, if any, system shortcomings. The MS II program budget and program schedules were essentially adhered to. The DOT&E MS III BLRIP report was positive. The Service IOT&E/OPEVAL report was positive, effective and suitable without caveat. (If not suitable, the deficiencies could be corrected without major impact, i.e., no SAR breach.)

Successful (Score of 4)

The ADM from MS II and MS III DABs was straightforward. There were system shortcomings. The MS II program budget and schedule were slipped but not by more than 30 percent in cost and 12 months in schedule. The DOT&E MS III BLRIP report was positive. The Service IOT&E/OPEVAL report was positive. The overall evaluation was effective and suitable, with perhaps a few marginally suitable parameters.

Fairly Successful (Score of 3)

The ADM from MS II and MS III DABs contained problem statements. The programs' shortcomings were listed; a few could be critical. The MS II program budget and schedule had to be revised but were within 45 percent of the MS II program budget and no more than 18 months behind the MS II schedule. The DOT&E MS III BLRIP report contained a few negative comments. The Service IOT&E/OPEVAL report could be marginally effective and marginally suitable.

Marginally Successful (Score of 2)

The ADM from MS II and MS III indicated major performance, and suitability problems existed. The program probably would be canceled on the basis of performance to date, but other external factors are being considered. The MS II program budget and schedule was revised more than once and is now up to 60 percent overrun in cost and two years behind the original schedule. The exit criteria of the MS II ADM were not completely met. An outcome of the MS III DAB would be to delay entry into full-rate production. The DOT&E MS III BLRIP report was marginally effective and/or marginally suitable. The Service IOT&E/OPEVAL report recommended, at best, that the system was potentially effective and potentially suitable.

Not Successful (Score of 1)

The ADM from the MS II DAB reluctantly approved the continuation of the program into EMD or held the program in the Demonstration/Validation phase. The MS II budget, if the program proceeds into EMD, is over 60 percent overrun; and the program is more than 2 years behind schedule. A DOT&E BLRIP report will say it is not effective and not suitable. This category would also include programs that have, in fact, been terminated. For programs that have not had their MS III DAB review as yet, their success will be judged on the general approach discussed herein and on the available official documentation.

APPENDIX D
SPREADSHEET COLUMN HEADINGS

<u>Column Number</u>	<u>Column Heading</u>
1	Program Name
2	Program Number
3	System Type
4	MS III Date/Actual
5	Notes
6	Service
7	Cost Success
8	Cost/Percent Overrun
9	Schedule Success
10	Schedule/Percent Overrun
11	IOT&E /OPEVAL Results
11a	Effectiveness
11b	Suitability
11c	Overall
12	DOT&E/BLRIP Evaluation
12a	Effectiveness
12b	Suitability
12c	Overall
13	MS II Date/Actual
14	MS III Date/Plan
15	MS III Date/Actual
16	EMD Plan/Years
17	EMD Actual/Years
18	EMD Duration Actual/Plan
19	EMD Overrun/Months
20	EMD RDT&E \$TY/Plan
21	EMD RDT&E \$TY/Actual
22	EMD RDT&E \$TY Actual/Plan
23	EMD Procurement \$/Plan
24	EMD Procurement \$/Actual
25	Procurement \$/Total Program
26	Proc \$ % EMD/Total
27	\$/Total Program
28	\$ % EMD/Total
29	PM Number
30	PM Average Tenure

**Column
Number**

Column Heading

31	SARs/Annual/Number
32	SARs/Exception/Number
33	SARs/%/Exception/Annual
34	LRIP/RDT&E \$
35	LRIP/Procurement (Proc) \$
36	LRIP/Total
37	Proc/Plan
38	Proc/Actual
39	Proc % Change/Plan/Actual
40	Proc/No. Change
41	LRIP RDT&E/Total %
42	LRIP Proc/Total %
43	LRIP Total/ Total %
44	LRIP RDT&E/Total LRIP %
45	Joint
46	ACTD
47	ACTD Duration
48	BLRIP
49	Modification (Mod)
50	S/W Intense
51	Tech Risk
52	PDRR Competition
53	EMD Competition
54	EMD Contract (Kr) Type
55	Subcontractors
56	EOA/OA Used
57	DT/OT Used
58	COI(E) Number
59	COI(S) Number
60	IOT&E Start/Plan
61	IOT&E Start/Actual
62	IOT&E End/Plan
63	IOT&E End/Actual
65	DT Start/Plan
66	DT Start/First Revision/Plan
67	DT Start/First Slip in Months
68	SAR Date/First Revision/DT Start
69	% EMD/SAR First Revision Report
70	DT Start/Actual
71	DT Start/Actual/Slip in Months

APPENDIX E

SPREADSHEET COLUMN DESCRIPTIONS

<u>Column Number</u>	<u>Description</u>
1	Program name
2	Program number (chronologically by MS III date)
3	System type
4	The actual date of the MS III DAB or equivalent for the Full-Rate Production (FRP) decision PDM
5	Notes (See the Table of Notes.)
6	The DoD Component or lead Service
7	The program EMD budget success rating assigned (See the study criteria.)
8	The actual percentage the program overran the planned EMD budget ((col 21 – col 20 ÷ col 20) X 100)*
9	The program EMD schedule success rating assigned (See the study criteria.)
10	The actual percentage the program overran the planned EMD schedule ((col 17 – col 16 ÷ col 16) X 100)*
11	The program EMD performance success rating assigned by the TE Department Subject-Matter Expert (SME) Panel after analyzing the Service Operational Test Activity (OTA) IOT&E or OPEVAL or TER report following study criteria. Success ratings for effectiveness, suitability and overall success are assigned.
12	The program EMD performance success rating assigned by the TE Department. SME Panel after analyzing the DOT&E BLRIP evaluation report. The same three success rating categories used for OTA reports are used here.
13	The actual date of the MS II DAB meeting PDM
14	The planned date (at MS II) for the program MS III DAB
15	The actual date of the MS III DAB (or equivalent for the FRP decision) PDM
16	The planned duration of EMD in years (col 14 – col 13)*
17	The actual duration of EMD in years (col 15 – col 13)*
18	The ratio of actual duration of EMD to the planned duration (col 17 ÷ col 16)*
19	The actual months the program overran the planned EMD schedule (col 17 – col 16)*
20	The planned RDT&E cost of EMD as estimated at MS II (TY\$)
21	The actual RDT&E cost of EMD as reported at MS III (TY\$)
22	The ratio of the actual RDT&E cost of EMD to the planned cost (col 21 ÷ col 20)*
23	The planned EMD Procurement (Proc) Cost as reported at MS II
24	The actual EMD Proc Cost as reported at MS III
25	The total program Proc Cost as reported at MS III
26	Percentage of EMD Proc Costs to total Proc Costs ((col 24 ÷ col 25) X 100)*
27	The total actual program costs as reported at MS III (col 21 + col 25)*

**Column
Number**

Description

28	Percentage of EMD costs to total program costs $((\text{col } 21 + \text{col } 24 \div \text{col } 25) \times 100)^*$
29	The number of Program Managers (PMs) assigned in EMD
30	The average tenure (years) of PMs assigned during EMD $(\text{col } 17 \div \text{col } 29)$
31	The number of annual Selected Acquisition Reports (SARs) issued covering EMD
32	The number of Exception SARs issued during EMD
33	The percentage of exception SARs to annual SARs $((\text{col } 32 \div \text{col } 31) \times 100)^*$
34	The number of LRIP systems purchased in EMD with RDT&E funds and presumably used for testing
35	The number of LRIP systems purchased in EMD with procurement funds and presumably used for other than test purposes
36	The total LRIP systems bought in EMD $(\text{col } 34 + \text{col } 35)^*$
37	Total planned quantity at MS II
38	Total actual quantity at MS III
39	Percent change in quantity from MS II to MS III $((\text{col } 37 - \text{col } 38 \div \text{col } 37) \times 100)^*$
40	Number of changes to planned procurement quantity during EMD
41	The percentage of LRIP RDT&E funded systems to total actual procurement at MS III $((\text{col } 34 \div \text{col } 38) \times 100)^*$
42	The percentage of LRIP procurement funded systems to the total actual procurement at MS III $((\text{col } 35 \div \text{col } 38) \times 100)^*$
43	The percentage of total LRIP systems purchased in EMD to total actual procurement at MS III $((\text{col } 36 \div \text{col } 38) \times 100)^*$
44	The percentage of RDT&E funded systems to total EMD systems $((\text{col } 34 \div \text{col } 36) \times 100)^*$
45	Is the system is being developed as a multi-Service (Joint) program? Yes/No
46	Advanced Concept Technology Demonstration (ACTD) or a special exception program? Yes/No
47	The duration of ACTD in years
48	Did DOT&E issue a BLRIP report? Yes/No
49	Indicates whether the program is a major modification (Yes) or a new development (No) in EMD
50	Is the program considered software-intensive? Yes/No
51	The PM's estimate of (technical) risk as stated at MS II
52	Did the program use prime contractor competition in the Program Definition/Risk Reduction (PDRR) phase of the program? Yes/No
53	Did the program use prime contractor competition in the EMD phase of the program? Yes/No
54	Indicates the type of contract used in EMD (FFP= Firm-Fixed-Price, FPI = Fixed-Price Incentive Fee, CPIF = Cost Plus Incentive-Fee, CPAF = Cost Plus Award-Fee)

**Column
Number**

Description

55	Number of associate contractors used at the prime system level (WBS Level II or III)
56	Were Early Operational Assessments (EOA) or Operational Assessments (OA) used? Yes/No
57	Was combined DT/OT used and mentioned in the SARs or OT reports? Yes/No
58	Number of Critical Operational Issues (Effectiveness) (COI(E)) shown in OT report
59	Number of Critical Operational Issues (Suitability) (COI(S)) shown in the OT report
60	The planned start date of IOT&E/OPEVAL
61	The actual start date of IOT&E/OPEVAL
62	The planned end date of IOT&E/OPEVAL
63	The actual end date of IOT&E/OPEVAL
64	The ratio of the actual duration of the IOT&E/OPEVAL test to the planned duration (col 61 to col 63 time interval ÷ col 60 to col 62 time interval)*
65	The planned start date (at MS II) of the first DT event in EMD
66	The first revised start date of the first DT event
67	The schedule slip in months of the first revised start date (col 66 – col 65)*
68	Date of the SAR reporting the first revised start date of the first DT event 69 percent into EMD at which the first revised DT start date is reported ((col 68 – MS II ÷ planned MS III – MS II) X 100)*
70	Actual start date of first DT event
71	Slip in actual start of first DT event (col 70 – col 65)*

*= Computer Generated Item

APPENDIX F

PROGRAM-SPECIFIC NOTES

X = Data is not available; usually the program had no SAR.
N/A = Data is not applicable.

1. Service IOT&E or OPEVAL Report was not available.
2. Evaluation rating based on DOT&E Annual Report
3. Anti-Satellite (ASAT): MS III was scheduled for Mar 1988, but in Dec 1987 the program was terminated due to a congressional moratorium on space testing.
4. Tri-Service Tactical Communications Program (TRITAC) switch: There was insufficient data in the FY86 DOT&E Annual Report to evaluate this program.
5. This is the first MAISARC program subject to evaluation by DOT&E.
6. SAR Production Baseline Estimate established at MS IIIA.
7. Single Channel Ground to Air Radio System (SINCGARS): This program had no EMD phase and, therefore, is not comparable.
8. BLRIP Report was written and included in the 1990 DOT&E Annual Report but submitted to the Congress only in Feb 1994
9. Cost data from Blue Books: "EMD RDT&E \$" are totals, not RDT&E only.
10. Joint Tactical Information Distribution System (JTIDS): OTA performance rating based on OPEVAL Report (OT-III) dated 19 Oct 1994
11. Full-Rate Production ADM issued 18 Oct 1995 without a formal DAB meeting
12. Not used
13. Not used
14. Forward Area Air Defense Command, Control, Communication and Intelligence (FAADC³I) and Ground Based Sensor (GBS)
15. Advanced Field Artillery Tactical Data System (AFATDS)
16. OPEVAL results are from FOT&E dated 28 Feb 1996.
17. Enhanced Position Location and Reporting System (EPLRS)
18. Joint Tactical Information Display System (JTIDS) Class 2 Terminals
19. Airborne Warning and Control System – Radar System Improvement Program (AWACS-RSIP)
20. Joint Direct Attack Munition (JDAM)
21. Division Air Defense (DIVAD): This program was terminated 27 Aug 1985 after 64 units were delivered and 3 years after MS III.
22. IOT&E results are from System Assessment dated Nov 1997.
23. The program didn't require a SAR; therefore, no cost, schedule or data elements beyond column 12 are available.
24. Final SAR data not currently available
25. This program was 91 percent through EMD before its first SAR was issued. Complete EMD trend data are not available.

26. Beginning with this program, the EMD cost figure is the then-year RDT&E cost total between MS II and MS III, as reported in the SAR. The same costs were used to compute Cost Success and Cost Percent Overrun.
27. Not used
28. IOT&E schedule data are not available from the SAR.
29. This program had multiple cost and technical variations and aspects. It is difficult to analyze using only SAR entries.
30. Combat Service Support Control System (CSSCS)
31. Ship Self-Defense System (SSDS)
32. Joint Stand-Off Weapon (JSOW)
33. Secure, Mobile, Anti-Jam, Reliable Tactical Terminal (SMART-T)
34. Close Combat Tactical Trainer (CCTT)
35. Army Tactical Missile System (ATACMS)
36. B-1B Block D Conventional Munitions Upgrade Program (CMUP)
37. Not used
38. This program was terminated while in EMD. The data contained within the SARs make it difficult to determine cost and schedule overruns accurately. Analyst estimates are used and explained in the research office files. Cost and Schedule success ratings, however, are accurate. Only RDT&E funds are shown in the SARs.
39. Costs are then-year RDT&E for aircraft and Defensive Avionics System CORE program until terminated. No MS III stated in SAR; end of IOT&E used for schedule overrun
40. MS IIIB DAB held May 1991 resulted in approval to continue LRIP until the BLRIP report was submitted to the Congress. This date is used to end EMD for this program.
41. This was an NDI program and the use of RDT&E funds for cost considerations may not be representative.
42. The production program was terminated. The end of EMD is taken as the date the contract for remaining LRIP items was signed.
43. MS II date was Apr 1983, but the first SAR was Dec 1989 due to special access program start.
44. Program featured NDI strategy and the SARs went from a planning estimate to the production estimate without a development estimate.
45. MS II was Sept 1982, but the first SAR was Dec 1985.
46. MS II was Feb 1980, but the first SAR was Dec 1985

APPENDIX G
EXCEL SPREADSHEET DATA

(Please see the following pages.)

1 Program	2 Program Number	3 System Type	4 MS III Date Actual	5 Notes	6 Service	7 Cost Success	8 Cost Percent Overrun	9 Schedule Success	19 EMD Overrun Months
ALCM	1	Mis/Mu-A	Apr-80	2, 9	Navy	3	45	4	8
TTC-39 (TRITAC Switch)	2	Elec-CNR-G	Jul-80	4, 9, 23	Army	1	71	2	22
SGT YORK gun (DIVAD)	3	Mis/Mu-G	May-82	9, 21	Army	1	64	2	20
JTIDS (Class 2 terminals)	4	Elec-CNR-A	Oct-93	9	AF	1	319	1	88
AV-8B (Harrier II)	5	Aircraft	May-85	9	Navy	4	27	4	1
OH-58D/AHIP	6	Elec-CNR-A	Oct-85	9	Army	4	13	4	4
Maverick AGM-65D (IIR)	7	Mis/Mu-A	Mar-86	9	AF	4	7	1	72
LANTIRN (Nav & Tgt)	8	Elec-CNR-A	Nov-86	9	AF	5	-5	2	20
Trident II msl (D-5)	9	Mis/Mu-G	Apr-87	2	Navy	5	-7	4	1
Tomahawk (TASM & TLAM-C)	10	Mis/Mu-G	Sep-87	9	Navy	1	68	1	80
CV HELO (SH-60F)	11	Elec-CNR-A	Mar-88	1	Navy	5	-8	5	0
ASAT (AF)	12	Mis/Mu-A	Mar-88	3, 46	AF	4	20	3	18
MK 48 ADCAP	13	Mis/Mu-G	Jan-89	45	Navy	4	13	1	24
Avenger (Ped Mtd Stinger)	14	Mis/Mu-G	Apr-90	44	Army	4	16	4	7
ATACMS	15	Mis/Mu-G	Nov-90		Army	4	12	3	14
ACM	16	Mis/Mu-A	Jul-91	1, 43	AF	4	4	3	13
MK 50 Torpedo (ALWT)	17	Mis/Mu-G	Sep-91	2, 42	Navy	2	48	1	29
Navstar GPS/U.E.	18	Elec-CNR-A	Jan-92	1, 9, 29	AF	5	-1	1	34
AMRAAM	19	Mis/Mu-A	Apr-92	1, 40	AF	4	16	1	64
PLS (FHTV) (NDI)	20	Vehicle	Dec-92	41	Army	5	-5	2	20
FAADS LOS-F-H (ADATS)	21	Mis/Mu-G	Dec-92	2	Army	1	63	1	32
B-1B Lancer (ALQ-161)	22	Elec-EW-A	Dec-92	2, 36, 39	AF	3	41	1	73
ASPJ (ALQ-165)	23	Elec-EW-A	Dec-92	30, 38	Navy	1	65	1	101
CHCS S/W Ver 4.01	24	AIS	Dec-92	1, 5, 23	OSD	X	X	X	X
NESP (AN/VSC-38V)	25	Elec-CNR-G	May-93	6, 25	Navy	X	X	4	5
SINCGARS	26	Elec-CNR-G	Sep-93	7	Army	X	X	X	X
M1A2 Tank	27	Vehicle	Apr-94	29	Army	4	12	5	0
T45TS	28	Aircraft	Jan-95	28	Navy	4	29	1	51

FAADC3I and GBS	29	Elec-CNR-G	Apr-95	14, 29	Army	4	31	1	39
FMTV	30	Vehicle	Aug-95		Army	3	39	1	55
Longbow Apache (AH-64)	31	Elec-CNR-A	Oct-95	11	Army	5	-37	5	-12
C-17A	32	Aircraft	Nov-95	6	AF	3	38	1	57
AFATDS	33	Elec-CNR-G	Dec-95	15	Army	5	3	2	20
SFW	34	Mis/Mu-A	Jun-96		AF	1	125	2	21
Std Msl (SM-2) Blk III	35	Mis/Mu-G	Jul-96		Navy	5	3	1	34
JSTARS	36	Elec-CNR-A	Sep-96		AF	1	201	1	57
CSSCS	37	Elec-CNR-G	Apr-97	30	Army	5	-2	1	44
Javelin	38	Mis/Mu-G	May-97	22	Army	1	63	1	35
AWACS-RSIP	39	Elec-CNR-A	Sep-97	19	AF	4	10	4	4
JSOW	40	Mis/Mu-A	Oct-98	32	Navy	4	10	4	3
SMART-T	41	Elec-CNR-G	Jan-99	12, 33	Army	4	27	4	4
B-1B CMUP Blk D JDAM	42	Elec-CNR-A	Feb-99		AF			4	1
MM III GRP	43	Elec-CNR-A	Dec-99		AF	3	43	1	31
F/A-18 E/F	44	Aircraft	Jun-00	13	Navy	5	-6	4	5
JDAM	45	Mis/Mu-A	Mar-01	20, 24	AF	5	-8	1	35
MIDS-LV T	46	Elec-CNR-A	Jul-01	24	Navy	4	21	4	1
STILL IN EMD									
DATA NOT FINAL									
PAC-3 Patriot (missile)	47	Mis/Mu-G	Sep-02		Army	1	196	1	49
B-1B CMUP Blk E (cmptr)	48	Elec-CNR-A	Mar-03		AF	4	3	1	26
AIM-9X (Sidewinder)	49	Mis/Mu-A	Jun-03		Navy	4	14	3	15
JASSM	50	Mis/Mu-A	Oct-03		AF	1	72	3	15
B-1B CMUP Blk F (DSUP)	51	Elec-CNR-A	Feb-04		AF	4	31	2	23
F-22 Raptor	52	Aircraft	Mar-04		AF	2	52	1	51
V-22 Osprey	53	Aircraft	Sep-05		Navy	4	16	1	57
RAH-66 Comanche	54	Aircraft	Jun-09		Army	4	2	1	30

1 Program	10 Schedule Percent Overrun	20 EMD RDT&E \$TY/Plan	21 EMD RDT&E \$TY Actual	22 EMD RDT&E \$TY Actual/Plan	29 PM Number	30 PM Average Tenure	31 SARs Annual Number	32 SARs Except Number	33 SARs % Except/Ann
ALCM	26	546.0	789.0	1.45	1	3.2	4	9	225%
TTC-39 (TRITAC Switch)	41	105.0	180.0	1.71					
SGT YORK gun (DIVAD)	59	163.0	267.0	1.64	3	1.5	7	17	243%
JTIDS (Class 2 terminals)	136	309.0	1,296.0	4.19					
AV-8B (Harrier II)	1	873.0	1,113.0	1.27	3	1.9	5	7	140%
OH-58D/AHIP	11	210.0	237.0	1.13	2	1.8	4	1	25%
Maverick AGM-65D (IIR)	172	100.0	107.0	1.07	5	1.9	11	21	191%
LANTIRN (Nav & Tgt)	32	512.3	488.7	0.95	4	1.7	6	1	17%
Trident II msl (D-5)	2	6,657.2	6,158.2	0.93	2	1.8	5	0	0%
Tomahawk (TASM & TLAM-C)	167	783.0	1,316.0	1.68	4	2.7	11	17	155%
CV HELO (SH-60F)	0	34.8	32.1	0.92	1	3.1	3	1	33%
ASAT (AF)	23	1,031.3	1,240.2	1.20	3	2.7	5	2	40%
MK 48 ADCAP	46	551.6	623.5	1.13	2	3.2	5	1	20%
Avenger (Ped Mtd Stinger)	17	9.2	10.7	1.16	4	1.0	4	2	50%
ATACMS	33	338.3	380.5	1.12	2	2.4	5	1	20%
ACM	15	1,402.7	1,455.2	1.04	1	8.3	4	3	75%
MK 50 Torpedo (ALWT)	46	709.9	1,049.8	1.48	5	1.5	9	3	33%
Navstar GPS/U.E.	29	942.0	937.0	0.99	5	2.5	13	12	92%
AMRAAM	126	645.9	748.8	1.16	4	2.4	8	3	38%
PLS (FHTV) (NDI)	57	35.3	33.5	0.95	2	2.3	4	2	50%
FAADS LOS-F-H (ADATS)	78	281.6	459.3	1.63	2	3.0	4	1	25%
B-1B Lancer (ALQ-161)	130	2,904.0	4,088.1	1.41	6	1.8	11	2	18%
ASPJ (ALQ-165)	168	341.0	561.0	1.65	3	4.5	10	1	10%
CHCS S/W Ver 4.01	X	X	X						
NESP (AN/VSC-38V)	4	X	X		X	X	2	0	0%
SINCGARS	X	X	X		X	X	X	X	X

M1A2 Tank	0	399.4	446.6	1.12	3	1.8	7	0	0%
T45TS	70	517.8	669.1	1.29	3	3.4	11	3	27%
FAAD C3I and GBS	59	308.9	403.4	1.31	3	2.9	10	4	40%
FMTV	172	64.1	89.0	1.39	3	2.4	8	4	50%
Longbow Apache (AH-64)	-17	598.9	377.3	0.63	3	1.6	7	2	29%
C-17A	79	3,934.7	5,424.3	1.38	5	2.2	11	3	27%
AFATDS	36	245.1	252.1	1.03	2	3.1	7	1	14%
SFW	20	79.4	178.5	2.25	5	2.1	11	4	36%
Std Msl (SM-2) Blk III	67	266.3	274.1	1.03	2	3.5	8	1	13%
JSTARS	130	657.1	1,975.7	3.01	4	2.1	8	3	38%
CSSCS	137	110.6	108.0	0.98	3	2.1	7	2	29%
Javelin	58	364.7	593.8	1.63	3	2.6	9	2	22%
AWACS-RSIP	4	384.3	424.4	1.10	4	2.2	8	1	13%
JSOW	4	450.6	494.3	1.10	3	2.1	6	1	17%
SMART-T	5	158.4	200.4	1.27	3	2.2	7	0	0%
B-1B CMUP Blk D JDAM	2				2	2.0	6	0	0%
MM III GRP	71	346.1	494.6	1.43	5	1.3	6	1	17%
F/A-18 E/F		5	5,563.8	5,256.0	0.94	4	2.0	10	0 0%
JDAM	113	267.0	246.7	0.92	3	1.8	8	1	13%
MIDS-LVT1	438.7	528.8	1.21	3	2.5	6	2	33%	
STILL IN EMD									
DATA NOT FINAL									
PAC-3 Patriot (missile)	96	954.6	2,823.4	2.96	4	2.1	5	4	80%
B-1B CMUP Blk E (cmptr)	36	240.9	248.4	1.03	3	2.7	4	1	25%
AIM-9X (Sidewinder)	24	425.3	483.5	1.14	2	3.3	6	1	17%
JASSM	34	407.8	699.5	1.72	2	2.4	3	1	33%
B-1B CMUP Blk F (DSUP)	39	314.7	411.3	1.31	2	3.4	5	0	0%
F-22 Raptor	51	14,030.1	21,313.1	1.52	3	4.2	9	3	33%
V-22 Osprey	59	4,043.4	4,673.2	1.16	4	3.2	8	1	13%
RAH-66 Comanche	38	8,179.0	8,338.0	1.02	1	9.2	0	1	

[illegible]

M1A2 Tank	29	62	91	2,926	1,060	-63.8%	2	2.7%	5.8%	8.6%	31.9%
T45TS	2	60	62	300	187	-37.7%	6	1.1%	32.1%	33.2%	3.2%
FAADC3I and GBS			0								
FMTV	147	2,000	2,147	119,542	85,488	-28.5%	3	0.2%	2.3%	2.5%	0.2%
Longbow Apache (AH-64)	10		10	227	227	0.0%	0		0.0%	4.4%	4.4%
C-17A	1	10	11	210	120	-42.9%	3	0.8%	8.3%	9.2%	0.8%
AFATDS	142			3,184	5,191	63.0%	4				
SFW	155	513	668	14,000	5,084	-63.7%	4	3.0%	10.1%	13.1%	3.0%
Std Msl (SM-2) Blk III	88			10,866	11,505	5.9%	5				
JSTARS	3	5	8	21	19	-9.5%	1	15.8%	26.3%	42.1%	15.8%
CSSCS	115	111	226	1,031	1,651	60.1%	5	7.0%	6.7%	13.7%	7.0%
Javelin	54	70,550	70,604								
AWACS-RSIP	5	4	9	34	32	-5.9%	2	15.6%	12.5%	28.1%	15.6%
JSOW	0	150	150	8,800	16,124	83.2%	3	0.0%	0.9%	0.9%	0.0%
SMART-T	0	52	52	366	320	-12.6%	4	0.0%	16.3%	16.3%	0.0%
B-1B CMUP Blk D JDAM	0	24	24	95	93	-2.1%	2	0.0%	25.8%	25.8%	0.0%
MM III GRP	0	83	83	652	652	0.0%	0	0.0%	12.7%	12.7%	0.0%
F/A-18 E/F	0	31	31	1000	219	-78.1%	2	0.0%	14.2%	14.2%	0.0%
JDAM	630	15,998	16,628	87,496	87,496	0.0%	0	0.7%	18.3%	19.0%	0.7%
MIDS-LVT	42	199	241	630	2499	296.7%	5	1.7%	8.0%	9.6%	1.7%
STILL IN EMD											
DATA NOT FINAL											
PAC-3 Patriot (missile)	0	164	164	1,200	1,159	-3.4%	4	0.0%	14.2%	14.2%	0.0%
B-1B CMUP Blk E (cmptr)	0	1	1	103	60	-41.7%	3	0.0%	1.7%	1.7%	0.0%
AIM-9X (Sidewinder)	45	954	999	10,000	10,097	1.0%	2	0.4%	9.4%	9.9%	0.4%
JASSM	88	176	264	2,400	3,700	54.2%	1	2.4%	4.8%	7.1%	2.4%
B-1B CMUP Blk F (DSUP)	0	0	0	95	60	-36.8%	3	0.0%	0.0%	0.0%	0.0%
F-22 Raptor	8	75	83	648	333	-48.6%	4	2.4%	22.5%	24.9%	2.4%
V-22 Osprey	2	59	61	523	456	-12.8%	2	0.4%	12.9%	13.4%	0.4%
RAH-66 Comanche	6	126	132	1,205	1,207	0.2%	1	0.5%	10.4%	10.9%	0.5%

1 Program	45 Joint	48 BLRIP	49 Mod	50 S/W Intense	51 Tech Risk	52 PDRR Compet	53 EMD Compet	54 EMD Kr Type	55 Subs	56 EOA/OA Used	57 DT/OT Used	58 COI(E) Number	59 COI(S) Number
ALCM	Yes	Yes	No	1	Mod	Yes	Yes	FPIF	2	No	No		
TTC-39 (TRITAC Switch)	X	No	No	1	Low	Yes	No	CPIF	1				
SGTYORK gun (DIVAD)	No	Yes	No	0	Med	No	Yes	FFP	Yes	No	No		
JTIDS (Class 2 terminals)	Yes	No	No	1			No		2				
AV-8B (Harrier II)	No	Yes	Yes	0	Med	No	No	CPIF	2	No			
OH-58D/AHIP	No	Yes	No	1	Low	No	No	FPIF	1				
Maverick AGM-65D (IIR)	No	Yes	Yes	0	Low	No	No	FPIF	1	No			
LANTIRN (Nav & Tgt)	No	Yes	No	1	X	Yes	No	FFP	1				
Trident II msl (D-5)	No	Yes	No	0	Low	No	No	CPIF	11	No			
Tomahawk (TASM & TLAM-C)	Yes	Yes	No	1	X	Yes	Yes	CPAF	7	No	Yes		
CV HELO (SH-60F)	No	Yes	Yes	0	Low	No	Yes	FFP	1	Yes			
ASAT (AF)	No	No	No	0	X	No	No	CPIF	3	No	No	X	X
MK 48 ADCAP	No	Yes	Yes	1	X	No	Yes	CPAF	2	Yes	No		
Avenger (Ped Mtd Stinger)	No	Yes	No	0	X	No	No	FFP					
ATACMS	No	Yes	No	0	Low	Yes	Yes	FPIF	1				
ACM	No	Yes	No	1	X	Yes	No	FPIF	3				
MK 50 Torpedo (ALWT)	No	Yes	No	0	Low	Yes	Yes	CPAF	3	Yes	No		
Navstar GPS/U.E.	Yes	Yes	No	1	Low	Yes	Yes	FPIF	0	Yes	Yes		
AMRAAM	Yes	Yes	No	0	Low	Yes	Yes	CPIF	1	No	Yes		
PLS (FHTV) (NDI)	No	Yes	No	0	X	Yes	No	FFP	3	Yes	Yes		
FAADS LOS-F-H (ADATS)	No	No	No	1	X	Yes	Yes	FFP	1				
B-1B Lancer (ALQ-161)	No	Yes	No	1	X	No	No	FPIF	2	No	Yes		
ASPJ (ALQ-165)	Yes	Yes	No	1	Low	Yes	Yes	CPAF	2	No	Yes		
CHCS S/W Ver 4.01				1									
NESP (AN/VSC-38V)	No	Yes	No	1	Med	Yes	Yes	FFP	X	Yes	Yes		
SINCGARS	No	Yes	No	1	X	Yes	Yes	CPIF	X				

M1A2 Tank	No	Yes	Yes	0	X	N/R	No	CPIF	5	Yes	No		
T45TS	No	Yes	No	0	X	Yes	Yes	FFP	X	No	Yes	9	10
FAAD C3I and GBS	No	Yes	No	1	X		No	CPIF	1		Yes		
FMTV	No	Yes	No	0	X	X	Yes	FFP	1	Yes	X	4	5
Longbow Apache (AH-64)	No	Yes	Yes	0	X	Yes	Yes	CPIF				3	3
C-17A	No	Yes	No	0	X		No	FPIF	8	Yes	Yes	5	8
AFATDS	No	Yes	No	1	Yes	No	No	CPAF		Yes	Yes	2	2
SFW	No	Yes	No	0				FPIF			Yes		
Std Msl (SM-2) Blk III	No	Yes	Yes	0	X		Yes	FFP/PI	0	No	Yes	4	8
JSTARS	Yes	Yes	No	1	X	X	No	FPIF	1	Yes	Yes	3	1
CSSCS	No	Yes	No	1	No		No	CPAF	0	Yes	No		
Javelin	Yes	Yes	No	0	X	Yes	Yes	FPI	1	Yes	Yes		
AWACS-RSIP	No	Yes	Yes	1	X	No	No	FPIF	2				
JSOW	Yes	Yes	No	0	No	X	No	CPIF	0	Yes			
SMART-T	Yes	Yes	No	1	No	X	Yes	CPIF	X				
B-1B CMUP Blk D JDAM	No	Yes	Yes	0	No	X	No	CPAF	1	Yes	Yes	33	26
MM III GRP	No	Yes	Yes	No	No	No	No	CPAF	2	Yes		7	7
F/A-18 E/F	No	Yes	Yes	No	No	No	No	CPA/I	1	Yes	No		
JDAM	Yes		No	No	No	Yes	No	CPAF	1	Yes	Yes		
MIDS-LVTYes		No	Yes		Yes	Yes	CPIF/AF	1	Yes				
STILL IN EMD													
DATA NOT FINAL													
PAC-3 Patriot (missile)	Yes		Yes	Yes	No	Yes	No	CPIF	1				
B-1B CMUP Blk E (cmptr)	No		No	Yes			No	CPAF	2				
AIM-9X (Sidewinder)	Yes		Yes	No		Yes	No	CPIF/AF		Yes	Yes		
JASSM	Yes		No	No	No	Yes	No	CPAF			Yes		
B-1B CMUP Blk F (DSUP)	No			Yes	No	No	No	CPAF					
F-22 Raptor	No		No	No		Yes	No	CPAF	1				
V-22 Osprey	Yes	Yes	No	No	No	No	No	CPAF	1	Yes		4	12
RAH-66 Comanche	No		No	Yes	No	Yes	No	CPAF					

[illegible]

M1A2 Tank	Mar-93	Sep-93	Dec-93	Dec-93	0.3								
T45TS			Mar-90	May-94		Jan-88	Mar-88	2	Dec-87	53.4%	Apr-88	3	
FAAD C3I and GBS	Sep-90	Sep-94	Jun-91	Dec-94	0.3	Jun-88	Oct-90	28	Dec-87	25.8%			
FMTV	Jul-92	Apr-95	Feb-93	Jul-95	0.4	Dec-89	Jan-90	1	Dec-89	59.4%	Jan-90	1	
Longbow Apache (AH-64)	Jan-95		Mar-95	Mar-95		Apr-92	Apr-92	0	Dec-90	0.0%	Apr-92	0	
C-17A	Jan-93	Jan-95	Aug-93	Jun-95	0.7	Aug-90	Jun-91	10	Dec-89	80.5%	Sep-91	13	
AFATDS	Jan-94	Jul-95	Feb-94	Sep-95	2.0	Jul-93	Oct-93	3	Dec-91	49.1%	Feb-94	7	
SFW	Jul-90					Jul-87	Oct-87	3	Dec-86	12.2%	Apr-88	9	
Std Msl (SM-2) Blk III	Jun-93			Apr-96		Feb-91	Mar-92	13	Dec-91	58.8%	Mar-92	13	
JSTARS	Dec-94	Dec-95	Aug-95	Mar-96	0.4	Nov-90	Mar-91	4	Dec-89	45.5%	Sep-91	10	
CSSCS	Feb-93	Jul-94	Apr-93	Sep-94	1.1	Dec-91	Mar-92	3	Dec-91	37.5%	Mar-92	3	
Javelin	Sep-93	Aug-95	Sep-94	Jun-96		Mar-91	May-91	2	Dec-90	30.0%	Feb-93	23	
AWACS-RSIP	Dec-93	Aug-95	Mar-94	Oct-96	4.7	Jan-91	May-91	4	Dec-90	23.8%	Sep-91	8	
JSOW	Aug-96	Feb-97	Jul-97	Sep-97	0.6	Nov-92	Jan-93	2	Dec-92	8.2%	Jan-93	2	
SMART-T	Feb-98	May-98	May-98	Jun-98	0.3	Jul-93	Mar-94	8	Dec-94	40.8%	Mar-94	8	
B-1B CMUP Blk D JDAM	Aug-97	Aug-97	Jun-98	Sep-98	1.3								
MM III GRP	May-95	Jun-96	May-97	Mar-98	0.9	Sep-94	Aug-95	11	Dec-93	8.1%	Feb-96	17	
F/A-18 E/F	Mar-99	May-99		Nov-99		Jan-94	May-94	4	Dec-92	7.3%	Jul-94	6	
JDAM	Sep-97	Nov-98	Dec-97			Oct-95	Dec-95	2	Dec-95	9.7%	Dec-95	2	
MIDS-LVT	Dec-00		Dec-00										
STILL IN EMD													
DATA NOT FINAL													
PAC-3 Patriot (missile)	Jan-98	Jan-02	Jun-98	Sep-02	1.6	Jan-97	Apr-97	3	Mar-96	42.9%	Sep-97	8	
B-1B CMUP Blk E (cmptr)	Sep-00	Dec-00	Jan-01	Nov-02	5.7	Jun-98	Jun-98	0	Dec-96	31.2%	Jun-98	0	
AIM-9X (Sidewinder)			Aug-01	Jan-03									
JASSM													
B-1B CMUP Blk F (DSUP)	Jun-01	Aug-01	Dec-01	Oct-03	4.3	Jul-98	Sep-98	2	Dec-98	33.9%	Sep-98	2	
F-22 Raptor	Jun-99	Apr-03	Sep-99	Dec-03	2.7	Oct-93	Aug-94	10	Dec-92	16.0%	Feb-95	16	
V-22 Osprey	May-99	Nov-04	Dec-99	Mar-05	0.6	Feb-99	Jul-99	5	Dec-97	63.0%	Jul-99	5	
RAH-66 Comanche	Jun-06	Dec-08	Oct-06	Apr-09	1.0								

